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SANITARY ENGINEERING.

Refuse Disposal and Power Production. By W. Francis Goodrich, A.M.Inst.M.E. Pp. xv+384. (Westminster: Constable and Co., Ltd., 1904.) Price 16*s.* net.

THE destruction of town refuse by fire is a comparatively modern development; the first furnaces erected for such a purpose were constructed to the designs of Mr. Fryer at Manchester in 1876, and these furnaces, though considerably modified, are still at work. The gross insanitary character of the ordinary system of refuse disposal is patent to everyone who has occasion to move about in the neighbourhood of any of our large cities; the refuse is deposited in tips; often an old quarry or gravel pit is selected for this purpose, and the refuse is dumped into these cavities until they are filled up. How unsatisfactory this is has been proved by the fact that outbreaks of disease have occurred directly traceable to the existence of these heaps of abomination. The author states that an outbreak at Fratton was certified by the medical authorities to be due to the contagion brought by flies bred in the pestiferous heaps of Portsmouth refuse which had been deposited in this neighbourhood. These refuse heaps in the summer time breed flies in millions, and they are the constant resort of rats, which spread from them all over the neighbourhood, and how readily most dangerous diseases are disseminated by both these agencies is well known to all medical authorities. We had this fact brought home to us clearly during the late campaign in South Africa, when the nurses and doctors in the field hospitals were frequently able to tell that a patient being brought in was a typhoid sufferer from the swarms of flies round him.

Fortunately the Local Government Board is setting its face steadily against a continuation of this insanitary practice, and the recent example at Bury St. Edmunds, quoted by Mr. Goodrich, where the board refused to sanction a loan for the purpose of purchasing land for a tip, is a striking illustration of this modern tendency. Refuse tipping at sea, owing to the fact that much of the refuse is liable to be washed back on the foreshore, and also that it has frequently to be stored for lengthy periods owing to stormy weather, is an equally unsatisfactory method.

The book is fully illustrated, and two or three of the illustrations, reproduced from photographs, show the filthy state of affairs brought about by town authorities neglecting to avail themselves of modern appliances. The author discusses very fully the various systems of burning refuse in destructors which have been adopted in this country, for it is chiefly in Great Britain that fire purification has been adopted, and the various systems of charging the refuse into the destructor cells are described in detail; the direct charging systems are compared very fairly with the hand or shovel feeding systems.

Though the former, from the sanitary point of view, naturally appears the more desirable, there can be little doubt from the figures given by Mr. Goodrich that there is not much economy in labour by the adoption of direct charging, since the labour of dragging the material from the drying hearth forward on to the grates is greatly increased. The first types, founded on a system of natural draught and low temperatures in the cells, undoubtedly did much to retard the development and the introduction of destructors, and in this connection to Mr. Charles Jones, of Ealing, must be given much credit, because his cremator certainly led the way to the design of the modern forced draught high temperature destructor.

Illustrations and descriptions are given of most of the destructors which have been used up to the present time, and then the author deals exhaustively with the labour cost in the different systems, with the utilisation of the clinker, and with the application of the steam generated to electricity works, sewage works, or waterworks. The figures given for the labour cost show very striking variations in the different towns, ranging from as low as 6¾*d.* per ton of refuse burnt to as high as 2*s.* 10*d.*; the higher cost in a few cases arises from the fact that the quantity of refuse to be destroyed is comparatively small, and therefore the three shift, eight hour system, which is the more economical, cannot be adopted.

The disposal of the clinker no longer presents any real difficulty, as in the modern destructor the temperature is easily kept high enough and sufficiently steady to produce a thoroughly hard, well burnt clinker suitable for many purposes. The late Mr. J. McTaggart, of Bradford, did much in directing attention to the various uses to which the clinker could be applied, and the results he obtained were remarkable; clinker bricks, clinker tiles, clinker mortar, clinker concrete were some of the products into which his waste material was converted, and Bradford led the way in showing that by the utilisation of this residuum, which amounts on an average to about one-third of the weight of the total refuse consumed, much of the cost of running a destructor can be repaid. The utilisation of the steam generated has also made great strides during the past few years, and at the present time there are, the author states, sixty combined electricity and destructor works either running or under construction in this country, several of them of considerable size, the electricity generated being used both for lighting and for traction.

The author gives a comparative statement showing the number of electrical units generated per ton of refuse destroyed in twenty of these stations, the figures ranging from as low as 15 to as high as 80 per ton of refuse burnt. He quotes, from reports of station engineers, opinions which show conclusively that whatever difficulties may have been experienced at first, owing to variations in the steam pressure, at the present time it is quite as easy to run a plant satisfactorily with steam produced from the waste heat of the destructor furnaces as when generated in an ordinary boiler using coal or other fuel. About thirty-eight towns are using steam from the destructors for driving pumping plants in connection with sewage dis-

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posal works, and the town of Sheerness has taken a still bolder departure in the application of such steam to work pumps supplying the town with water. This latter scheme was carried out by the author himself, and he is thus able to give full details as to the economical results of this installation; the first six months' working showed a saving of nearly 500*l.*, equal to a reduction of 3*d.* per 1*l.* in the town rates. The comparative advantages of steam jet blowers and fans are contrasted, and Mr. Goodrich clearly leans towards the former as the more economical in the long run; in this connection he lays great stress upon the absolute necessity of systematic tests of the waste gases in order to determine whether or not combustion is going on under the most economical conditions; a diagram given on p. 157 shows how serious the heat losses may be if excess air is used.

The second half of the book is devoted to a description of all the refuse destructors which have been put to work in Great Britain and abroad up to the present time. The date of the installation, the type and make of destructor, the number of cells, the number and type of boilers, height of chimney, the type of draught used, the purpose for which the power is used, the weight of the refuse destroyed daily, and the labour cost per ton of refuse destroyed are all given. Most complete information in regard to this important subject has thus been brought together, and there can be no doubt that it will prove a most useful reference volume to those engaged in planning such plants, and to municipal authorities who are considering the desirability of erecting destructors. Up to the present the various details and results given by Mr. Goodrich have been scattered through the *Proceedings* of one or two of our engineering societies, or embodied in the reports of borough engineers, and it can have been no light task to gather together the mass of information in this book. We have no hesitation in saying that it will be a standard book of reference for several years to come, and it is in a form in which it will be comparatively easy, in the re-issue of fresh editions from time to time, to keep it up to date.

T. H. B.

GEMS AND PRECIOUS STONES.

Precious Stones, a Popular Account of their Characters, Occurrence and Applications, with an Introduction to their Determination, for Mineralogists, Lapidaries, Jewellers, &c., with an Appendix on Pearls and Coral. By Prof. Max Bauer. Translated from the German, with additions by L. J. Spencer. Pp. 627; with 20 plates and 94 figures in the text. (London: Charles Griffin and Co., Ltd., 1904.) Price 42*s.* net.

Gems and Gem Minerals. By Dr. Oliver Cummings Farrington. Pp. 229; with 16 coloured plates and 60 half-tone and line engravings. (Chicago: A. W. Mumford, 1903.)

THE publication in 1890 by the Scientific Publishing Company of New York of Dr. G. F. Kunz's valuable "Gems and Precious Stones of North America" showed for the first time the possibility of producing, by modern methods of photolithography, illustrations of gems, either cut or uncut, which would give some idea of their characteristic colour, transparency and lustre. The two works of which the titles appear above have adopted the same methods of illustration, and the plates are scarcely inferior in beauty and in fidelity to the originals to those which adorn Dr. Kunz's well known book.

Prof. Max Bauer's "Edelsteinkunde" was issued in parts in 1895 and 1896, and at once took a foremost place in scientific literature as the standard work on all subjects relating to gems. It deals not only with the methods adopted by mineralogists and others for determining the mineral species to which gem stones must be referred, but with such questions as their artificial production, counterfeiting of gems, and their alteration by heating, &c.—questions upon which it is often very difficult to obtain satisfactory and trustworthy information. While mainly devoted to gems viewed from the scientific standpoint, much valuable information is added on the cutting, mounting and price of gems, while the accounts of the localities and mode of their occurrence are exceptionally full and complete, the descriptions being illustrated by sketch-maps and plans of workings. The coloured plates give some idea of the brilliancy and exquisite beauty of the original objects, whether these be crystals in their matrix or cut stones. They are scarcely, if at all, inferior in these respects to those in the work of Dr. Kunz already referred to, and higher praise than this can scarcely be given.

Mr. Spencer has been well advised in undertaking the translation, with the aid of his wife, of this important standard work. But the book as it now appears in English dress is much more than a mere translation. Mr. Spencer's familiarity with the bibliography of mineralogy is well known, and he brings to his task, in addition, wide knowledge and experience gained in connection with his work in the splendid national collection of minerals at South Kensington. The author of the work has supplied references to the more important papers which have been issued since the first appearance of the book, and these with many other works, including the valuable annual reports on the production of gem stones by the United States Geological Survey, have been consulted by the translator, many new and valuable facts being added. It would be easy to show, however, that even during the decade that has not quite elapsed since the book was written, much new information has accumulated on many of the subjects dealt with, and to incorporate this, as the translator points out in the case of the diamond, so as to bring the matter quite up to date, would involve the complete re-writing of whole sections. The work is, nevertheless, so complete, trustworthy and up to date that no better guide to the study of gems can be indicated to the student, the worker, or the dealer in these interesting objects.

The general account of precious stones occupies 110 pages, and, as the translator admits, would have to be considerably enlarged if full justice were done to the optical methods of discriminating the mineral species. This, however, would have only a limited

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